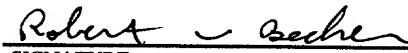




FORM PTO-1390 (REV. 1-98)		DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371			
INTERNATIONAL APPLICATION NO. PCT/EP98/05432	INTERNATIONAL FILING DATE 26 August 1998	ATTORNEY'S DOCKET NUMBER A 90 475	
TITLE OF INVENTION SHAFT LOCKING DEVICE		U.S. APPLICATION NO. (If known, see 37 CFR 1.5 Unknown	
APPLICANT(S) FOR DO/EO/US Wilhelm Geis and Manuela Menrath		PRIORITY DATE CLAIMED 26 August 1997	
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:			
<p>1. <input checked="" type="checkbox"/> This is a FIRST submission of items concerning a filing under 35 U.S.C. 371.</p> <p>2. <input type="checkbox"/> This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371.</p> <p>3. <input checked="" type="checkbox"/> This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).</p> <p>4. <input type="checkbox"/> A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.</p> <p>5. <input type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371(c)(2))</p> <p>a. <input type="checkbox"/> is transmitted herewith (required only if not transmitted by the International Bureau).</p> <p>b. <input checked="" type="checkbox"/> has been transmitted by the International Bureau.</p> <p>c. <input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US).</p> <p>6. <input checked="" type="checkbox"/> A translation of the International Application into English (35 U.S.C. 371(c)(2)).</p> <p>7. <input type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))</p> <p>a. <input type="checkbox"/> are transmitted herewith (required only if not transmitted by the International Bureau).</p> <p>b. <input type="checkbox"/> have been transmitted by the International Bureau.</p> <p>c. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired.</p> <p>d. <input type="checkbox"/> have not been made and will not be made.</p> <p>8. <input type="checkbox"/> A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).</p> <p>9. <input checked="" type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).</p> <p>10. <input type="checkbox"/> A translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).</p>			
Items 11. to 16. below concern document(s) or information included:			
<p>11. <input checked="" type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.97 and 1.98.</p> <p>12. <input checked="" type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.</p> <p>13. <input checked="" type="checkbox"/> A FIRST preliminary amendment.</p> <p><input type="checkbox"/> A SECOND or SUBSEQUENT preliminary amendment.</p> <p>14. <input type="checkbox"/> A substitute specification.</p> <p>15. <input type="checkbox"/> A change of power of attorney and/or address letter.</p> <p>16. <input checked="" type="checkbox"/> Other items or information: Affidavit</p>			
<p>"Express Mail" Mailing Label Number: <u>EL 298 278 247</u></p> <p>Date of Deposit <u>April 26, 1999</u></p> <p>I hereby certify that this paper or file is being transmitted to the United States Patent and Trademark Office to Addressee" service under 37 CFR 1.10, on the date indicated above and is addressed to the Commissioner of Patents and Trademarks, Washington, D.C. 20231. <u>Bernice Marquez</u> Bernice Marquez, Sec'y</p>			

U.S. APPLICATION NO. (If known, see 37 CFR 1.5) Unknown	INTERNATIONAL APPLICATION NO. PCT/EP98/05432	ATTORNEY'S DOCKET NUMBER A 90 475																																											
<p>17. <input type="checkbox"/> The following fees are submitted:</p> <p>BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)): Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO \$1070.00</p> <p>International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO \$930.00</p> <p>International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO \$790.00</p> <p>International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) \$720.00</p> <p>International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) \$98.00</p>		CALCULATIONS PTO USE ONLY																																											
ENTER APPROPRIATE BASIC FEE AMOUNT =		\$ 840.00																																											
<p>Surcharge of \$130.00 for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(e)).</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>CLAIMS</th> <th>NUMBER FILED</th> <th>NUMBER EXTRA</th> <th>RATE</th> </tr> </thead> <tbody> <tr> <td>Total claims</td> <td>- 20 =</td> <td></td> <td>x \$22.00</td> </tr> <tr> <td>Independent claims</td> <td>- 3 =</td> <td></td> <td>x \$82.00</td> </tr> <tr> <td colspan="2">MULTIPLE DEPENDENT CLAIM(S) (if applicable)</td> <td></td> <td>+ \$270.00</td> </tr> <tr> <td colspan="2" style="text-align: right;">TOTAL OF ABOVE CALCULATIONS =</td> <td style="text-align: right;">\$ 840.00</td> </tr> <tr> <td colspan="2"> <p>Reduction of 1/2 for filing by small entity, if applicable. A Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28).</p> </td> <td style="text-align: right;">+</td> </tr> <tr> <td colspan="2" style="text-align: right;">SUBTOTAL =</td> <td style="text-align: right;">\$ 840.00</td> </tr> <tr> <td colspan="2"> <p>Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(f)).</p> </td> <td style="text-align: right;">\$</td> </tr> <tr> <td colspan="2" style="text-align: right;">TOTAL NATIONAL FEE =</td> <td style="text-align: right;">\$ 840.00</td> </tr> <tr> <td colspan="2"> <p>Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property +</p> </td> <td style="text-align: right;">\$ 40.00</td> </tr> <tr> <td colspan="2" style="text-align: right;">TOTAL FEES ENCLOSED =</td> <td style="text-align: right;">\$ 880.00</td> </tr> <tr> <td colspan="2"></td> <td style="text-align: right;">Amount to be refunded: \$</td> </tr> <tr> <td colspan="2"></td> <td style="text-align: right;">charged: \$</td> </tr> </tbody></table>		CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	Total claims	- 20 =		x \$22.00	Independent claims	- 3 =		x \$82.00	MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ \$270.00	TOTAL OF ABOVE CALCULATIONS =		\$ 840.00	<p>Reduction of 1/2 for filing by small entity, if applicable. A Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28).</p>		+	SUBTOTAL =		\$ 840.00	<p>Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(f)).</p>		\$	TOTAL NATIONAL FEE =		\$ 840.00	<p>Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property +</p>		\$ 40.00	TOTAL FEES ENCLOSED =		\$ 880.00			Amount to be refunded: \$			charged: \$	
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE																																										
Total claims	- 20 =		x \$22.00																																										
Independent claims	- 3 =		x \$82.00																																										
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ \$270.00																																										
TOTAL OF ABOVE CALCULATIONS =		\$ 840.00																																											
<p>Reduction of 1/2 for filing by small entity, if applicable. A Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28).</p>		+																																											
SUBTOTAL =		\$ 840.00																																											
<p>Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(f)).</p>		\$																																											
TOTAL NATIONAL FEE =		\$ 840.00																																											
<p>Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property +</p>		\$ 40.00																																											
TOTAL FEES ENCLOSED =		\$ 880.00																																											
		Amount to be refunded: \$																																											
		charged: \$																																											
<p>a. <input checked="" type="checkbox"/> A check in the amount of \$ 880.00 to cover the above fees is enclosed.</p> <p>b. <input type="checkbox"/> Please charge my Deposit Account No. _____ in the amount of \$ _____ to cover the above fees. A duplicate copy of this sheet is enclosed.</p> <p>c. <input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 02-1653. A duplicate copy of this sheet is enclosed.</p> <p>In the event there is any discrepancy in the amount sent herewith or at anytime in the future, please charge any additional fee or credit any overpayment to the above deposit account number.</p> <p>NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137 (a) or (b)) must be filed and granted to restore the application to pending status.</p>																																													
<p>SEND ALL CORRESPONDENCE TO:</p> <p>ROBERT W. BECKER & ASSOCIATES 11896 N. Highway 14 Suite B Tijeras NM 87059</p>																																													
 <p>SIGNATURE</p> <p>Robert W. Becker</p> <p>NAME</p> <p>26,255</p> <p>REGISTRATION NUMBER</p>																																													

510 Rm 202 PCT/PCT 26 APR 1999

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

"Express Mail" Mailing Label Number EL 298 278 247 US
Date of Deposit April 26, 1999

I hereby certify that this paper or fee is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 on the date indicated above and is addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231.

Bernice Marquez
 Bernice Marquez, Sec'y

In the application of: Wilhelm Geis and Manuela Menrath

Serial Number: unknown (based on PCT/EP98/05432)

International Filing Date: August 26, 1998

For: SHAFT LOCKING DEVICE

Assistant Commissioner for Patents

Washington, D.C. 20231

PRELIMINARY AMENDMENT

Prior to the first Office Action, please amend the above identified application as follows:

IN THE SPECIFICATION:

Page 1: after the title, insert the following heading:

-- Background of the Invention --;

lines 3-4, delete "according to the preamble of claim 1, in particular";

between lines 14 and 15, please insert the following heading:

-- Summary of the Invention --;

delete line 15.

Page 3: between lines 15 and 16, please insert the following heading:

-- Brief Description of the Drawings --.

Page 4: before line 7, please insert the following heading:

-- Description of Preferred Embodiments --.

Page 10: after the last line, please insert the following paragraph:

-- The specification incorporates by reference the entire disclosure of German priority document 297 15 257.2 of August 26, 1997, as well as of International Application PCT/EP98/05432 of August 26, 1998.

The present invention is, of course, in no way restricted to the specific disclosure of the specification and drawings, but also encompasses any modifications within the scope of the appended claims. --.

IN THE CLAIMS:

Please cancel claims 1-16 and replace them with the attached claims 17-32.

IN THE ABSTRACT:

Please add the attached Abstract of the Disclosure.

R E M A R K S

Claims 17-32 are pending in the application; claim 1-16 have been cancelled.

Appropriate headings have been added to the specification, a proper Abstract of the Disclosure has been added. Furthermore, the claims from the literal translation have been replaced by claims drafted in conformity with U.S. Patent practice.

The application in its amended state is believed to be in condition for allowance.

Respectfully submitted,

Gudrun Huckett

Ms. Gudrun E. Huckett, Reg. No. 35,747, for the applicant

Robert W. Becker & Associates
11896 N. Highway 14, Suite B
Tijeras, NM 87059

Telephone: (505) 286-3511
Telefax: (505) 286-3524

-/GEH
Enclosures - claims 17-32
- Abstract of the Disclosure

WHAT IS CLAIMED IS:

17. A shaft locking device for a spindle (1, 1a, 1b) of a motor-driven, hand-guided work tool, said shaft locking device comprising:

a spindle (1, 1a, 1b);

a driven member (4, 4a, 4b) fixedly connected to said spindle (1, 1a, 1b);

a freewheel (28) having locking members (22);

a ring (23), fixedly connected to a housing, wherein said locking members (22) engage said ring (23) in both rotating directions of said spindle (1, 1a, 1b);

a drive member (3, 3a, 3b) coaxially arranged to said spindle (1, 1a, 1b) and provided with unlocking members (10, 10a, 10b), wherein said unlocking members (10, 10a, 10b) co-operate with said locking members (22) in order to release said locking members (22) when said driving member (3, 3a, 3b) is driven such that said driven member (4, 4a, 4b) is released from said ring (23) and is rotatable;

said driven member (4, 4a, 4b) and said drive member (3, 3a, 3b) having torque-transmitting catch surfaces (18, 18a, 18b, 19, 19a, 19b) for a motor-driven drive action of said spindle (1, 1a, 1b), whereby said catch surfaces (18, 18a, 18b, 19, 19a, 19b) have a larger distance from one another in a neutral position of said drive member (3, 3a, 3b) than a distance provided between said unlocking

members (10, 10a, 10b) and respectively associated ones of said locking members (22);

 said drive member (3, 3a, 3b) having cams (11, 11a, 11b) that are spatially separated from said unlocking member (10, 10a, 10b), wherein said cams (11, 11a, 11b) penetrate into said driven member (4, 4a, 4b);

 said driven member (4, 4a, 4b) having catch openings (30);

 wherein said torque-transmitting catch surfaces (18, 18a, 18b, 19, 19a, 19b) are formed by cam surfaces (18, 18a, 18b) of said cams (11, 11a, 11b) and by drive surfaces (19, 19a, 19b) of said catch openings (30) facing said cam surfaces (18, 18a, 18b) in a respective rotational direction of said spindle (1, 1a, 1b).

18. A shaft locking device according to claim 17, wherein said spindle (1, 1a, 1b) is a one-piece member and penetrates said driven member (4, 4a, 4b) and said drive member (3, 3a, 3b), wherein said spindle (1, 1a, 1b) serves as a support for said drive member (3, 3a, 3b).

19. A shaft locking device according to claim 17, wherein said drive member (3, 3a, 3b) is a toothed wheel (7, 7a, 7b).

20. A shaft locking device according to claim 19, wherein said toothed wheel (7, 7a, 7b) has plastic teeth (31).

21. A shaft locking device according to claim 17, wherein said cams (11) extend axially or radially into said catch openings (30)

and wherein said catch openings (30) are embodied as ring segments (17).

22. A shaft locking device according claim 17, wherein said cams (11a, 11b) extend axially or radially into said catch openings (30) and wherein said catch openings (30) are embodied as radial recesses (17a, 17b).

23. A shaft locking device according to claim 17, wherein said unlocking members (10, 10a, 10b) and the cams (11, 11a, 11b) are arranged concentrically to one another, wherein said unlocking members (10, 10a, 10b) embrace said driven member (4, 4a, 4b) at a spacing.

24. A shaft locking device according to claim 17, wherein said drive member (3, 3a, 3b) has at least two pairs of symmetrically embodied ones of said unlocking members (10, 10a, 10b) and said cams (11, 11a, 11b), wherein each one of said pairs has a common center line (12) that is positioned at an equally spaced angle to neighboring ones of said center lines (12).

25. A shaft locking device according to claim 17, wherein said driven member (4, 4a, 4b) is embodied as a deep-drawn sheet metal member (13) or as an extruded member (13a) or as a thick disc (13b).

26. A shaft locking device according to claim 25, wherein said sheet metal member (13) or said extruded member (13a) or said disc (13b) is provided with circumferential cams (21) for said locking

members (22).

27. A shaft locking device according to claim 25, further comprising a closing member (27, 27b) fixedly attached to said driven member (4, 4a, 4b), wherein said closing member (27, 27b) has a clearance-free contact to said sheet metal member (13) or to said steel member (13b) and has axial clearance to said locking members (22).

28. A shaft locking device according to claim 17, wherein said cams (21) and associated one of said locking members (22) are arranged in pairs.

29. A shaft locking device according to claim 17, further comprising spring elements (24) arranged between said locking members (22).

30. A shaft locking device according to claim 17, wherein said cam surfaces (18, 18b) of said cams (11, 11b) are radially aligned with said drive surfaces (19, 19b) of said catch openings (30).

31. A shaft locking device according to claim 17, wherein said driven member (4, 4a) is positive-lockingly connected to said spindle (1, 1a).

32. A shaft locking device according to claim 17, wherein said driven member (4b) is force-lockingly connected said spindle (1b).

Abstract of the Disclosure

A shaft locking device for a spindle of a motor-driven, hand-guided work tool has a driven member fixedly connected to the spindle. A freewheel is provided that has locking members. A ring, fixedly connected to a housing, is engaged by locking members in both rotating directions of the spindle. A drive member is coaxially arranged to the spindle and provided with unlocking members, wherein the unlocking members co-operate with the locking members in order to release locking members when the driving member is driven such that the driven member is released from the ring and is rotatable. The driven member and the drive member have torque-transmitting catch surfaces for a motor-driven drive action of the spindle, whereby the catch surfaces have a larger distance from one another in a neutral position of the drive member than a distance provided between the unlocking members and respectively associated ones of the locking members. The drive member has cams that are spacially separated from the unlocking member, wherein the cams penetrate into the driven member. The driven member has catch openings. The torque-transmitting catch surfaces are formed by cam surfaces of the cams and by drive surfaces of the catch openings facing the cam surfaces in a respective rotational direction of the spindle.



Shaft Locking Device

The invention relates to a shaft locking device for the spindle of a motor-driven, hand-guided work tool according to the preamble of claim 1, in particular.

5 A shaft locking device of the aforementioned kind is described in US 3,243,023 which comprises a drive member with four unlocking elements for the locking members of a freewheel and where the unlocking elements are simultaneously designed as cams for engaging a driven member. The torque-transmitting surfaces of the cams and the driven member are designed to be very small in this solution and they are, therefore, subject to wear.

10

It is an object of the invention to create a shaft locking device for the spindle of a motor-driven, hand-held work tool that has a long service life.

15

The object is solved by the characterizing features of claim 1.

Due to the spacial separation of unlocking elements and cams, there is space for sufficiently dimensioned torque-transmitting drive surfaces which are practically not subject to any wear.

20

Because of the one-piece design of the spindle and its penetration of the drive member and the driven member, it has a simple design

and a stable support. This support of the spindle in connection with a loosely dimensioned support of the drive member on the spindle contributes to the long service life and the efficiency of the work tool, particularly if the drive member is embodied as a toothed wheel.

5 When its teeth are made of plastic, there are noise-related advantages.

Because the axial cams penetrate the catch openings, the entire torque transferring drive surfaces are always active, even in the event of axial mounting deviations of the spindle.

10 Because of the positioning of the unlocking members and of the cams, manufacturing advantages exist for turning and milling the drive member. The cams can axially or radially penetrate or extend into the catch openings.

15 The deep-drawing or extruding of the driven member offers also advantages in regard to manufacturing the cams for the locking members and to flattening of the hub. The driven member can also be embodied as a thick disc which is preferably made of sintered steel. This realizes a particularly low wear and safe operation of the shaft locking device. The number of the locking members depends

20 on the magnitude of the operational load.

The fixedly driven closing ring serves to limit the axial movement of the locking members of the free wheel and, thereby, its noise

development. This is particularly important with hammer devices. In the case of different length ratios, the fixedly driven closing ring can be substituted by a standardized disc and, in the event that no hammer device is present, it can even be left out.

- 5 Advantageously, the cam surfaces of the cams are radially aligned with the drive surfaces of the catch openings. This provides favorable torque transmission and wear conditions.
- 10 A particularly torsionally strong connection between the driven member and the spindle is achieved when the driven member is positive-lockingly connected to the spindle.
- 15 Advantageously, the driven member is force-lockingly connected to the spindle. This can be achieved by a press fit, for example. Thereby, a slip-clutch-like slip between the driven member and the spindle is possible on an extreme load acting on the spindle so that a destruction due to breaking-stress can be avoided.

More features can be taken from the further claims. The drawings schematically illustrate the embodiments of the invention which are described in the following. It is shown in:

- Fig. 1 a longitudinal section of the shaft locking device,
- 20 Fig. 2 a cross-section of the shaft locking device,

Fig. 3 a longitudinal section of another shaft locking device,

Fig. 4 a cross-section of another shaft locking device,

Fig. 5 a longitudinal section of a preferred further embodiment of the shaft locking device,

5 Fig. 6 a cross-section of the preferred further embodiment of the shaft locking device.

Figs. 1 and 2 show a spindle 1 with a thread 29 for the drill chuck and a ball bearing 2 as well as a drive member 3 and a driven member 4.

10 The interior ring of the ball bearing 2 is axially supported on a shoulder 6 of the spindle 1 by a locking ring 5. A second bearing provided at the driving end of the spindle 1 is not illustrated.

15 The driving member 3 consists of a toothed wheel 7 that has an end gearing and is supported on the spindle 1. The toothed wheel 7 is axially fixed with axial play by a further locking ring 8 and a shoulder 9 of the spindle 1. For noise-related reasons, the gearing can be comprised of plastic. At the end face of the toothed wheel 7 facing the driven member 4, three unlocking members 10 and three axial cams 11 are arranged in pairs concentrically with respect to one another. The three pairs each have a common center line 12, and

20

neighboring center lines 12 are provided at equal spacings.

The driving member 3 can also be embodied as a planetary gearing and be provided with a two-position gear box.

5 The driven member 4 is provided with a deep-drawn, pot-shaped sheet metal member 13, whose hub 14 is fixedly connected to the spindle 1 by two flattened portions 15. The hub 14 can also be fixedly connected to the spindle 1 by a press fit or other kind of frictional connection or by positive locking. In the wall 16 of the sheet metal member 13 facing the drive member 3, three catch openings 30 embodied as ring segments 17 are provided which are radially engaged with rotary play by the three axial cams 11 of the toothed wheel 7. The cam surfaces 18 and drive surfaces 19 of the sheet metal member 13, which face one another in the direction of rotation, are radially aligned and are positioned opposite one another with a clearance.

10

15

20 The sheet metal member 13 is provided with an outer ring-shaped wall 20 having an outer shape that is embodied as cams 21 for the locking members 22. The locking members 22 are positioned as pairs in the area between the catch openings 30 and are arranged between the outer wall 20 and a ring 23 fixedly attached to the housing. The locking members 22 are being pressed apart by spring elements 24 (for example, metal or plastic springs) and are held in a clamping position on the cams 21. The cams 21, the locking

members 22, and the ring 23 attached to the housing together form a freewheel 28. The number of the locking member pairs is dependent on the operational torque to be expected.

5 The unlocking members 10 embrace the outer, ring-shaped wall 20 of the metal member 13 at a spacing. They are provided at their end faces 25 facing the locking members 22 a shaped surface matching the locking members 22. The distance between the shaped surface and the locking members 22 is smaller than the one between the cam surfaces 18 and the drive surfaces 19.

10 The ring 23, fixedly attached to the non-represented housing of the work tool, is positive-lockingly connected, for example, by a toothed ring 26.

15 The sheet metal member 13 is provided at the side facing away from the driven member 4 with a closing member 27 that is fixedly connected to the spindle 1 and limits the axial movement of the locking members 22 and, thereby, the resulting noise development. This is particularly important with hammer devices. If this is missing, the closing member 27 can be eliminated.

20 Figures 3 and 4 illustrate another version of the shaft locking device. The same parts carry the same designation as in Figs. 1 and 2, analogous parts carry a designation extended by an "a".

5 In this version, differently designed cams 11a of a differently designed toothed wheel 7a of a differently designed drive member 3a engage with play corresponding radial recesses 17a of an extruded member 13a belonging to a differently designed driven member 4a. This extruded member 13a is fixedly connected to a different spindle 1a.

10 At the circumference of the extruded member 13a, between the radial recesses 17a, cams 21 (according to Figs. 1 and 2) are provided that can be connected by locking members 22 to the ring 23 fixedly attached to the housing. The locking members 22 are held axially by a closing member 27a that is connected to the differently designed cams 11a.

15 The torque of the drive motor is transmitted by differently designed cam surfaces 18a to differently designed drive surfaces 19a of the extruded member 13a.

20 Differently designed unlocking members 10a embrace the extruded member 13a at a spacing. The distance between the differently designed end surfaces 25a of the differently designed unlocking members 10a facing the locking members 22 and the locking members 22 is smaller than between the differently designed cam surfaces 18a and the differently designed drive surfaces 19a of the extruded member 13a.

Figures 5 and 6 illustrate another preferred embodiment of the shaft clamping device. The same parts carry the same designation as in Figs. 1 and 2, analogous parts carry a designation extended by a "b".

5 In this embodiment, the cams 11b of a different toothed wheel 7b are similarly designed as the cams 11a shown in Figs. 4, whereby differently designed cam surfaces 18b of the cams 11b are approximately radially aligned with different drive surfaces 19b of the catch opening 30. These are embodied as differently designed radial recesses 17b. The cams 11b project radially and axially with a play into the corresponding recesses 17b of a differently designed driven member 4b which is embodied as a thick disc 13b. The driven member 4b is provided with a different hub 14b which is fixedly and force-lockingly connected to a different spindle 1b by press fit.

10 At the circumference of the disc 13b dovetailed cams 21 according to Figs. 1 to 4 are provided between the radial recesses 17b. The cams 21 can be connected to the ring 23, fixedly attached to the housing, by locking members 22. The locking members 22 are held axially by a differently designed closing member 27b which is fixedly connected to the spindle 1b.

15 The torque of the drive motor is transmitted by different cam surfaces 18b to different drive surfaces 19b of the disc 13b.

5 Different unlocking elements 10b embrace the disc 13b at a spacing. The distance to the end surfaces 25 of the unlocking members 10b facing the locking members 22 is smaller than between the different cam surfaces 18b and the different drive surfaces 19b of the disc 13b. In this embodiment, the locking members 22 rest against the corresponding ends 25 of the different unlocking members 10b, due to the spring action of the spring element 24 arranged between them.

10 The illustrated shaft locking devices operate as follows:

15 On operation of the motor, the toothed wheel 7, 7a, 7b is rotated on the spindle 1, 1a, 1b. Thereby, first, the first locking elements 22 as viewed in the direction of rotation are shifted into the recess of the cams 21 by the unlocking members 10, 10a, 10b and are thereby unlocked. Only then, the cam surfaces 18, 18a, 18b engage the drive surfaces 19, 19a, 19b of the driven member 4, 4a, 4b whereby also the second locking member 22 and, thereby, the freewheel 28 as an entity are unlocked. The spindle 1, 1a, 1b, together with the drive member 3, 3a, 3b and the driven member 4, 4a, 4b, can now freely rotate and transmit torque.

20 When the drive of the spindle 1, 1a, 1b rests, the axial cams 11, 11a, 11b and the unlocking members 10, 10a, 10b are positioned in neutral position without any contact to the driven member 4, 4a, 4b and the locking members 22. The latter are held in a locking

5

10

position by the spring elements 24. On rotating the spindle 1, 1a, 1b by hand, one of the locking members 22 is engaged in the direction of the locking position and the other one in the unlocking direction, respectively, whereby the locking members 22 switch their function when the direction of rotation is changed. In this manner, a firm rotation connection to the housing of the work tool is always present when the spindle 1, 1a, 1b is rotated manually. This situation can be utilized for opening or closing, or screwing on and off the drill chuck with one hand. Thereby, a double bush drill chuck is not required which is expensive and has to be handled with both hands. Another advantage of the shaft locking device is that a screw can be manually screwed in and out by using the work tool as an effective screw driver.

Claims

1. Shaft locking device for a spindle (1, 1a, 1b) of a motor-driven, hand-guided work tool, particularly, a drill or hammer drill, comprising a driven member (4, 4a, 4b) that is fixedly connected to the spindle (1, 1a, 1b) and can be engaged in both rotating directions of the spindle (1, 1a, 1b) by locking members (22) of a freewheel (28) by a ring (23), fixedly connected to the housing, further comprising a drive member (3, 3a, 3b) which is coaxially arranged to the spindle (1, 1a, 1b) and is provided with unlocking members (10, 10a, 10b) which co-operate with the locking members and release the locking members when the driving member (3, 3a, 3b) is driven such that the driven member (4, 4a, 4b) is released from the ring (23) fixedly connected to the housing and is rotatable, and further comprising torque-transmitting catch surfaces (18, 18a, 18b, 19, 19a, 19b) provided at the driven member (4, 4a, 4b) and the drive member (3, 3a, 3b) for the motor-driven drive of the spindle (1, 1a, 1b), whereby the catch surfaces (18, 18a, 18b, 19, 19a, 19b) have a larger distance from one another in neutral position of the drive member (3, 3a, 3b) than the distance provided between the unlocking member (10, 10a, 10b) and the associated locking member (22), characterized in that the drive member (3, 3a, 3b) is provided with cams (11, 11a, 11b) that are spatially separated from the unlocking member (10, 10a, 10b) and that the cams (11, 11a, 11b) penetrate into the driven member (4, 4a, 4b).

5

10

15

20

25

5

member (4, 4a, 4b), whereby the torque-transmitting catch surfaces (18, 18a, 18b, 19, 19a, 19b) are formed by cam surfaces (18, 18a, 18b) of the cams (11, 11a, 11b) and by drive surfaces (19, 19a, 19b) of catch openings (3) facing those cam surfaces (18, 18a, 18b) in the respective rotational direction.

10

2. Shaft locking device according to claim 1, characterized in that the spindle (1, 1a, 1b) is designed as one piece and penetrates the driven member (4, 4a, 4b) and the drive member (3, 3a, 3b), whereby the spindle (1, 1a, 1b) serves as a support for the drive member (3, 3a, 3b).
3. Shaft locking device according to one of the claims 1 or 2, characterized in that the drive member (3, 3a, 3b) is embodied as a toothed wheel (7, 7a, 7b).

15

4. Shaft locking device according to claim 3, characterized in that the toothed wheel (7, 7a, 7b) is provided with teeth (31) made of plastic.

20

5. Shaft locking device according to one of the claims 1 through 4, characterized in that the cams (11) extend axially or radially into the catch openings (30) which are embodied as ring segments (17).

DEUTSCHE
PATENT-
UNDP
DE 693 221

6. Shaft locking device according one of the claims 1 through 4, characterized in that the cams (11a, 11b) extend axially or radially into the catch openings (30) which are embodied as radial recesses (17a, 17b).
- 5 7. Shaft locking device according to one of the claims 1 through 6, characterized in that the unlocking members (10, 10a, 10b) and the cams (11, 11a, 11b) are arranged to be concentrically to one another, whereby the unlocking elements (10, 10a, 10b) embrace the driven member (4, 4a, 4b) at a spacing.
- 10 8. Shaft locking device according to one of the claims 1 through 7, characterized in that the drive member (3, 3a, 3b) is provided with at least two pairs of symmetrically embodied unlocking members (10, 10a, 10b) and cams (11, 11a, 11b), with a pair-wise common center line (12) and an equally spaced angle between the neighboring center lines (12).
- 15 9. Shaft locking device according to one of the claims 1 through 8, characterized in that the driven member (4, 4a, 4b) is embodied as a deep-drawn sheet metal member (13) or as an extruded member (13a) or as a thick disc (13b).
- 20 10. Shaft locking device according to claim 9, characterized in that the sheet metal member (13) or the extruded member

(13a) or the disc (13b) is provided at its circumference with cams (21) for the locking members (22) of the freewheel (28).

5 11. Shaft locking device according to claims 9 or 10, characterized in that a fixedly connected driven closing ring (27, 27b) is provided with a clearance-free contact to the sheet metal member (13) or to the steel member (13b) and has axial clearance to the locking members (22) of the freewheel (28).

10 12. Shaft locking device according to claims 10 or 11, characterized in that the cams (21) and the associated locking members (22) are arranged as pairs.

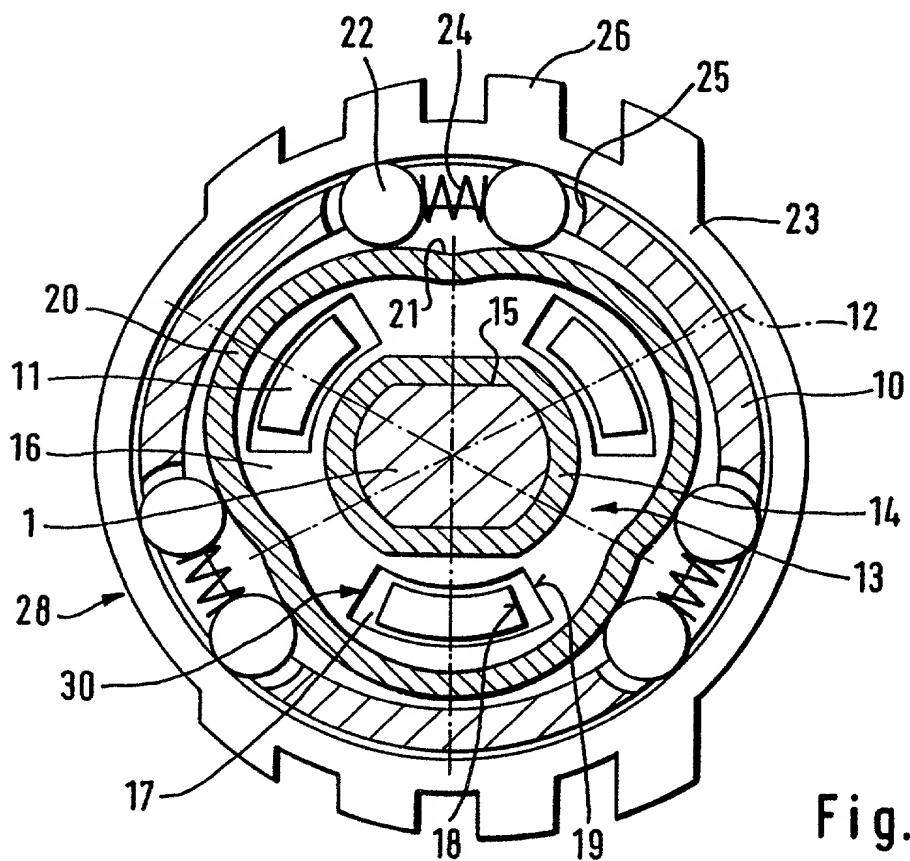
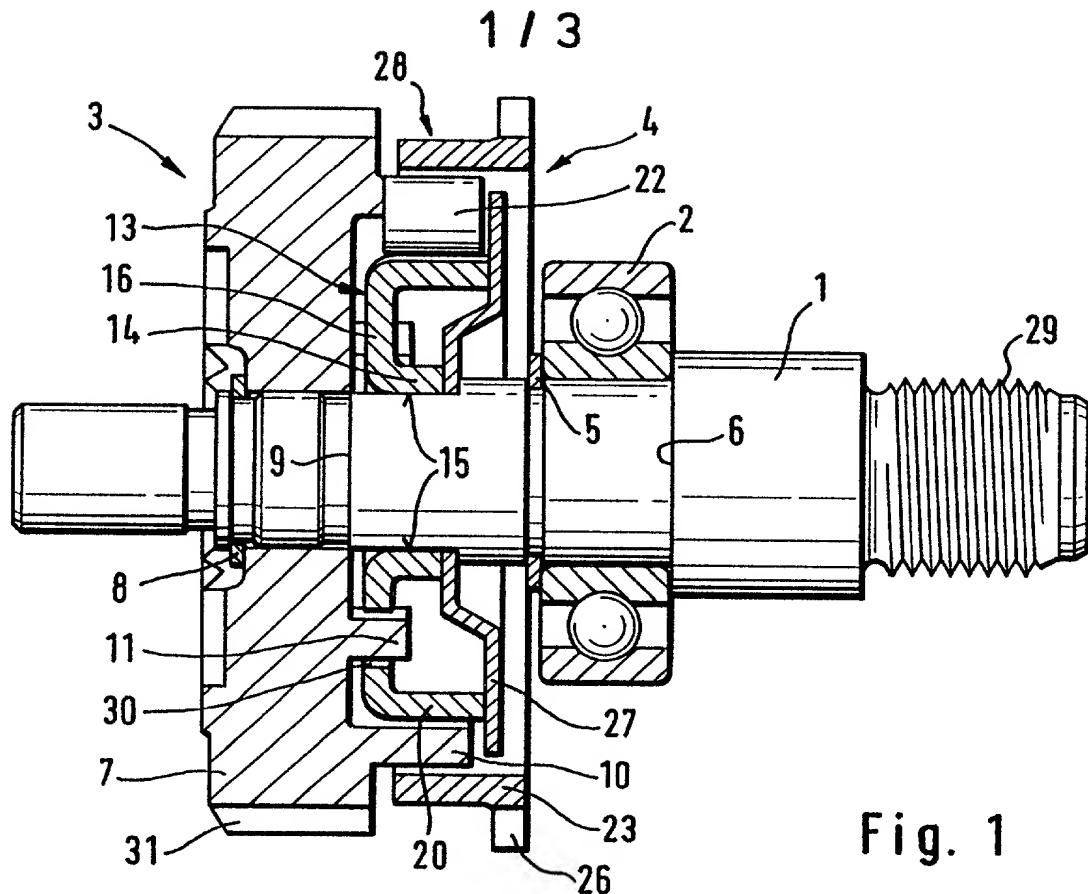
15 13. Shaft locking device according to claim 12, characterized in that spring elements (24) are arranged between the locking members (22).

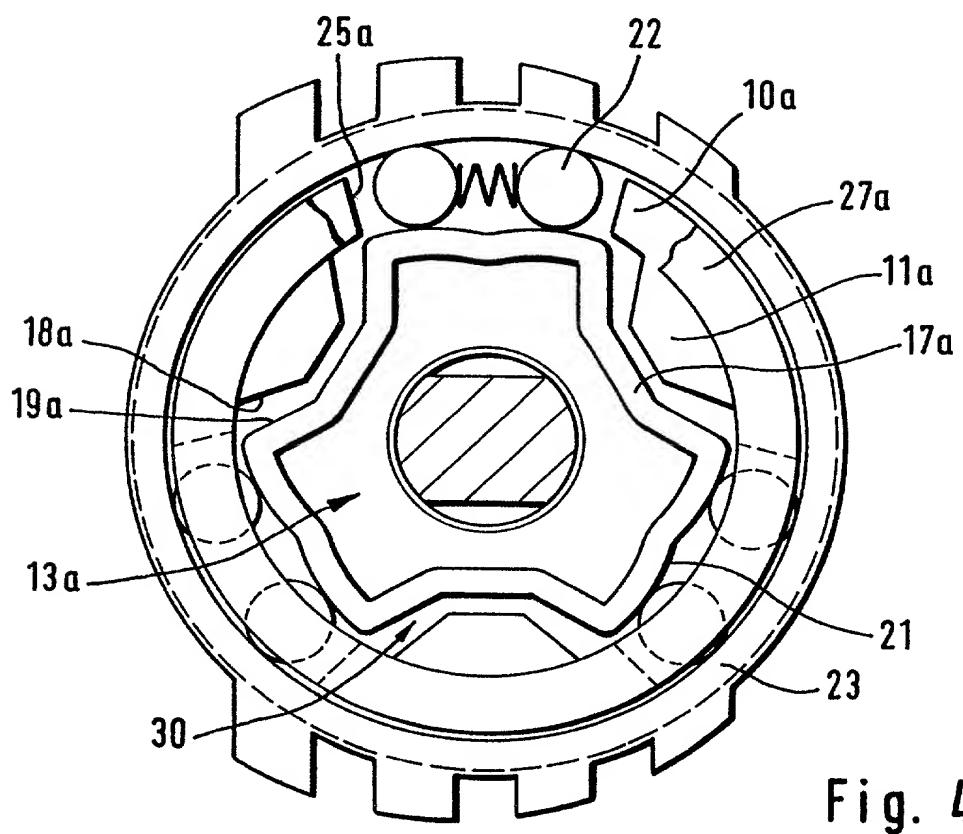
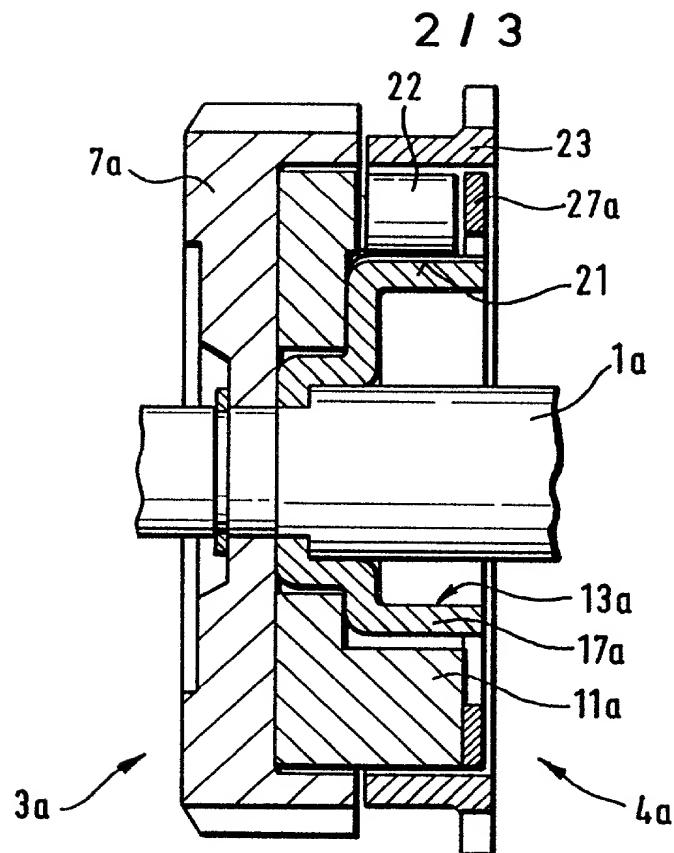
20 14. Shaft locking device according to one of the claims 1 through 13, characterized in that the cams (18, 18b) of the cams (11, 11b) are radially aligned with the drive surfaces (19, 19b) of the catch openings (30).

15. Shaft locking device according to one of the claims 1 through 14, characterized in that the driven member (4, 4a) is

positive-lockingly connected to the spindle (1, 1a).

16. Shaft locking device according to one of the claims 1 through 14, characterized in that the driven member (4b) is force-lockingly connected the spindle (1b).





3 / 3

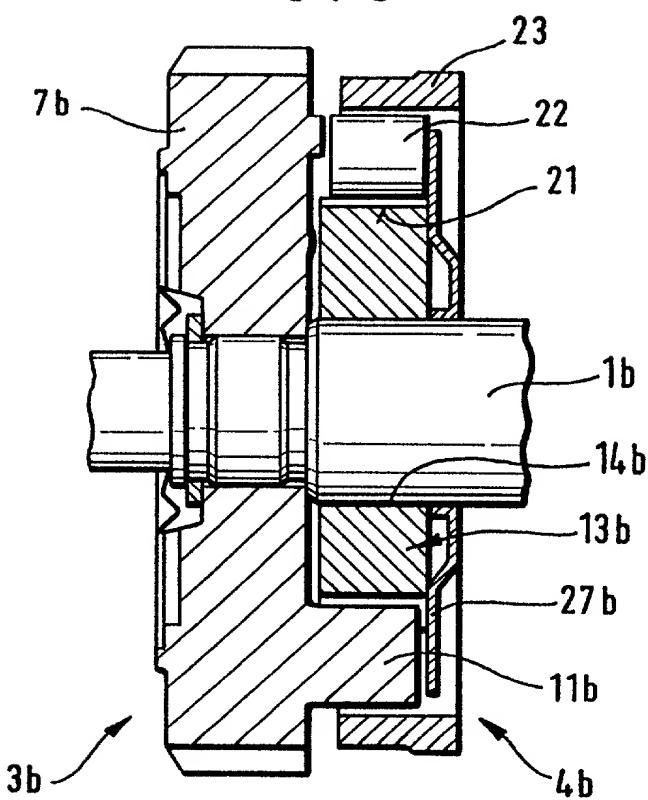


Fig. 5

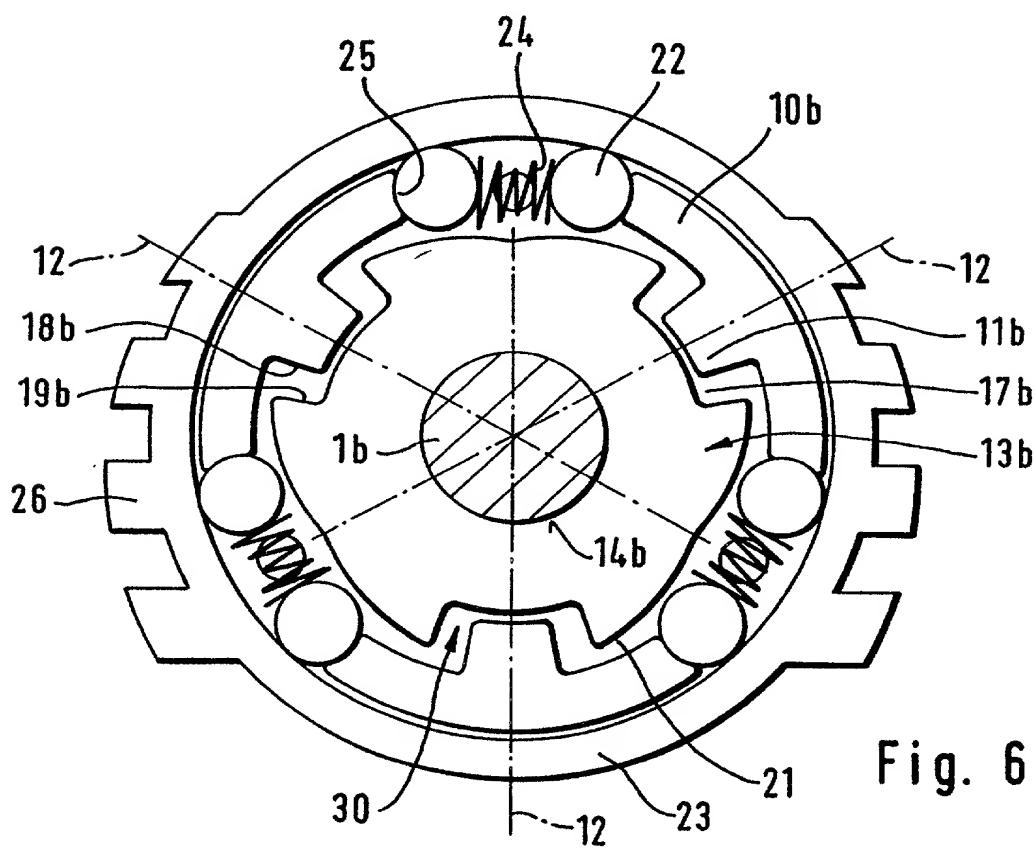


Fig. 6

COMBINED DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:
 My residence, post office address and citizenship are as stated below next to my name; I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought of the invention entitled:

SHAFT LOCKING DEVICE

the specification of which
 is attached hereto;
 was filed on _____ as Application Ser. No. _____ and
 was amended on _____.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose all information known by me to be material to the patentability of this application in accordance with Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s):

Priority
Claimed:

297 15 257.2

Germany *DEX*

26th August 1997

(Number)	(Country)	(Day/Month/Year Filed)	Yes	No
----------	-----------	------------------------	-----	----

I hereby appoint the following attorneys, Robert W. Becker, Reg. No. 26,255, and patent agent, Gudrun E. Huckett, Reg. No. 35,747, to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith. Address all telephone calls to (505) 286-3511. Address all correspondence to ROBERT W. BECKER & ASSOCIATES, 11896 N. Highway 14, Suite B, Tijeras, New Mexico 87059.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of sole or first inventor: Geis, Wilhelm

Inventor's signature *Wilhelm Geis* Date: April 16, 1999
 Residence: Mühlefeldstr. 8, 71397 Leutenbach, Germany
 Citizenship: German

Post Office Address: (same as above)

Full name of second inventor, if any: Menrath, Manuela

Inventor's signature *Manuela Menrath* Date: April 16, 1999
 Residence: Meisenweg 3, 71364 Winnenden, Germany
 Citizenship: German
 Post Office Address: (same as above)

Full name of third inventor, if any:

Inventor's signature _____ Date: _____
 Residence:
 Citizenship:
 Post Office Address: